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U	U	U	UU	3	19b. TELEPHONE NUMBER (Include area code) 505-277-6286

Final Report

Symposium on Nano- and Micro-scale Mechanics of Engineering Materials

Principal Investigator: Prof. Yu-Lin Shen
(Point of Contact) Department of Mechanical Engineering
University of New Mexico
MSC 01 1150
Albuquerque, NM 87131
Tel: 505-277-6286
Fax: 505-277-1571
Email: shenyl@unm.edu

Agency Contact: Dr. A. K. Vasudevan
Office of Naval Research
800 N Quincy St. Code 332
Arlington, VA 22217-5660
Tel: 703-696-8181
Fax: 703-696-0934
Email: vasudea@onr.navy.mil

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Amidst the rapid advancement of nano-technologies, the key role played by mechanics and mechanical characterization techniques cannot be overemphasized. Research on experimental, theoretical and computational mechanics enables the bridging of science and technology of all engineering materials and devices. We thus organized this symposium encompassing a broad spectrum of application areas and yet focusing on the mechanics and mechanical characterization at the nano- and micro-scales. The basic venue of the symposium is on a mixture of keynote addresses and short lectures given by top-notch researchers in the fields. The primary objective is to forge a synergistic interaction among materials scientists and solid mechanicians working toward the advancement of nano- technologies.

The symposium, titled “Nano- and Micro-scale Mechanics of Engineering Materials,” was held on November 28th and 29th, 2006, at the Norton’s Woods Conference Center, American Academy of Arts and Sciences (136 Irving Street, Cambridge, MA). The organizing committee consisted of the following members: Prof. Yu-Lin Shen (Project PI, University of New Mexico), Dr. Ming Dao (Massachusetts Institute of Technology), Prof. Lisa Pruitt (University of California at Berkeley), Prof. Upadrasta Ramamurty (Indian Institute of Science), and Prof. Takeshi Ogawa (Aoyama Gakuin University).

The presentation titles and speakers include:

Discrete Dislocation Modeling of Contact and Friction – Alan Needleman (Brown University)

Interactions between Dislocations and Grain Boundaries – Jeff De Hosson (University of Groningen)

Deformation and Fracture of Fiber-Reinforced Metals: From Experiments to Virtual Testing – Andreas Mortensen (Swiss Federal Institute of Technology in Lausanne) and Javier Llorca (Polytechnic University of Madrid)

The Strongest Size – Ali Argon (Massachusetts Institute of Technology)

Yield Point of Metallic Glass – Ju Li (Ohio State University)

Multi-Scale Instrumented Indentation Studies of Deformation in Bulk Metallic Glass - Raj Vaidyanathan (University of Central Florida)

Size Effects in Mechanical Behavior – Helena Van Swygenhoven (Paul Scherrer Institute)

CGS Interferometry as a Full-field Wafer Inspection Method: Obtaining Film Stress in the presence of Non Uniformities – Ares Rosakis (California Institute of Technology)

An Analysis of Non-Uniform Stress States in Finite Thin-Film/Substrate Systems: The Need of Full-Field Curvature Measurements – Young Huang (University of Illinois at Urbana-Champaign)

Probabilistic Theory of Fracture of Brittle Heterogeneous Materials Based on Activation Energy and Maxwell-Boltzmann Statistics – Zdenek Bazant (Northwestern University)

On the Role of Aging, Disease and Therapeutic Treatment in Affecting the Fracture of Bone – Robert Ritchie (University of California at Berkeley)

Magneto-Mechanical Actuation of Ferromagnetic Fibre Networks and its Application for Bone Growth Stimulation – Bill Clyne (University of Cambridge)

Nanobiomechanical Approaches to Studying Human Diseases – C. T. Lim (National University of Singapore)

Biomimetic Attachment Devices – Eduard Arzt (Max-Planck-Institut für Metallforschung)

Imaging Gene Expression in Living Cells with Nanostructured Probes – Gang Bao (Georgia Institute of Technology)

3-D Characterization of Soft Materials with Application to Biological Cell Studies - G. Ravichandran (California Institute of Technology)

The Significance of Membrane Binder Mobility for Cell Adhesion – Ben Freund (Brown University)

Mechanical Mapping of Dynamic Surfaces: From Crystals to Cells – Krystyn Van Vliet (Massachusetts Institute of Technology)

What Can We Get from Continuum Modeling of Indentation? – Nuwong Chollacoop (National Metal and Materials Technology Center, Thailand)

Also, the following researchers served as co-chairs of the technical sessions: Roger Kamm (Massachusetts Institute of Technology), Huajian Gao (Brown University), Brett Conner (Air Force Office of Scientific Research), Jimmy Hsia (National Science Foundation), Rod Clifton (Brown University), Bob Asaro (University of California at San Diego), Sharvan Kumar (Brown University), Bill Nix (Stanford University), Lallit Anand (Massachusetts Institute of Technology).

A total of 90 researchers attended the symposium, which offered a nice forum for presentation and discussion of timely research in nano- and micro-scale probing, characterization and mechanics of crystalline and amorphous materials and structures.

Financial Report

ONR awarded University of New Mexico a total of \$10,000, of which \$7,937 was the direct cost. The exact amount of \$7,937 was paid to the Norton's Woods Conference Center for the auditorium rentals and audio-visual services.